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***ORIGINAL ARTICLE***

# Differences of Lateral Cephalometry Values between Australo-Melanesian and Deutero-Malay Races

**Cristiany[1], Arlia E. Budiyanti[2], Adi Hidayat[3], Hamilah D. Koesoemahardja[4]**

*[1] Postgraduate Program, Faculty of Dentistry, Trisakti University, Jakarta 11440, Indonesia*
*[2] Department of Pedodontics, Faculty of Dentistry, Trisakti University, Jakarta 11440, Indonesia*
*[3] Department of Public Health, Faculty of Medicine, Trisakti University, Jakarta 11440, Indonesia*
*[4] Department of Orthodontics, Faculty of Dentistry, Trisakti University, Jakarta 11440, Indonesia*
*Correspondence e-mail to: cristianyafan@yahoo.com*

## ABSTRACT

Cephalometric is extensively used to study the facial morphology that supports orthodontic diagnosis and treatment planning. Correct cephalometric analyses need reference values obtained from the same ethnic, gender and age population of orthodontic patients. **Objective:** To compare the difference of lateral cephalometric values between Australo-Melanesian and Deutero-Malay race in 16 to 20 years of age subjects with normal occlusion. **Methods:** An observational with cross-sectional design study on 200 subjects (100 males and 100 females) from Australo-Melanesian and Deutero-Malay race was performed. Lateral cephalometric radiographs were taken, traced and analyzed. **Results:** Mann Whitney U test showed significant differences on SNA angle with median 84° for Australo-Melanesian race and 83° for Deutero-Malay race. Lower lip distance to aesthetic line 3mm for Australo-Melanesian race and 1mm for Deutero-Malay race also showed significant difference. Independent t-test showed significant differences in FM angle with mean 27.45±4.49° for Australo-Melanesian race and 28.14±5.36° for Deutero-Malay race, and upper I to APg angle 36.28±4.72°for Australo-Melanesian race and 32.69±6.24° for Deutero-Malay race. **Conclusion:** The Australo-Melanesian race had more protruded maxilla to cranial base, more flat mandibular plane, more proclined upper incisors, and more frontal lower lip to aesthetic line compared to Deutero-Malay race.

## ABSTRAK

**Perbedaan nilai sefalometri lateral antara ras Australo-Melanesia dan *Deutero-Malay*.** Sefalometri telah digunakan secara luas untuk mempelajari bentuk fasial yang membantu diagnosis dan rencana perawatan ortodonti. Analisis sefalometri secara benar menggunakan nilai referensi dari populasi yang sama dengan pasien ortodonti sesuai dengan kelompok etnik, jenis kelamin dan usianya. **Tujuan:** Untuk menganalsis perbedaan nilai pengukuran radiografis sefalometri lateral antara ras Australo-Melanesia dan *Deutero-Malay* pada subjek yang telah melewati masa pertumbuhan yaitu usia 16 sampai 20 tahun dan memiliki oklusi normal. **Metode:** Jenis penelitian ini adalah observasional dengan rancangan potong silang. Subjek penelitian sebanyak 200 orang, terdiri dari 100 laki-laki dan 100 perempuan ras Australo-Melanesia dan *Deutero-Malay*. **Hasil:** Uji Mann Whitney U pada variabel yang penyebaran datanya tidak normal menunjukkan perbedaan bermakna ($p$<0,05) pada sudut SNA dengan nilai kisaran 84° pada ras Australo Melanesia dan 83° pada ras *Deutero-Malay*. Perbedaan bermakna juga ditemukan pada nilai jarak bibir bawah ke garis estetis 3mm pada ras Australo-Melanesia dan 1mm pada ras *Deutero-Malay*. Uji *t* independen pada variabel yang penyebaran datanya normal menunjukkan perbedaan bermakna ($p$<0,05) pada sudut FM dengan rata-rata dan standar deviasi 27,45±4,49° pada ras Australo-Melanesia dan 28,14±5,36° pada ras *Deutero-Malay* dengan sudut I atas ke APg 36,28±4,72° pada ras Australo-Melanesia dan 32,69±6,24° pada ras *Deutero-Malay*. **Simpulan:** Australo-Melanesia memiliki maksila yang lebih protrusi terhadap basis kranialis, bidang mandibula yang lebih datar, gigi insisivus atas lebih proklinasi, dan bibir bawah terletak lebih di depan bidang estetik dibandingkan dengan *Deutero-Malay*.

**Key words:** Australo-Melanesian, Deutero-Malay, lateral cephalometric

## INTRODUCTION

Numerous studies found that lateral cephalometry radiograph values are different among various ethnic and racial groups. This indicates that normal values in one group do not mean normal in other groups so that each racial group should be analyzed independently according to the characteristics of each group.[1,2] To apply the correct analysis, cephalometry reference values used in the analysis must be obtained from the same population with orthodontic patients according to their ethnic group, gender and age.[3] It also stated that the analysis performed on lateral cephalogram refers to the reference value which depends on the characteristics of race, age and gender.[4] Accordingly, dentists and orthodontists should plan orthodontic treatment based on reference values of each ethnic or racial group of the patients.[5]

Lateral cephalometry radiograph is necessary for craniofacial examination. Cephalometry has been used extensively to study the facial shape and define normality to aid orthodontic diagnosis and treatment planning. Cephalometry is also used to assess treatment progress and craniofacial growth, predicting each patient's growth, and for other purposes in orthodontics.[6] A list of the best known cephalometry analysis that includes 23 analyses was introduced between the year 1946 to 1985.[7] These analyses mostly used reference values obtained from subjects of Caucasoid and often only a few number of subjects. Some of these methods did not study the difference for age and sex.[8] Since its introduction in 1931, lateral cephalometry radiograph has become one of the important tools in orthodontics and orthodontic clinical research.[8] Afterwards, cephalometric unit has greatly evolved. The distance of light tube, objects and films have been determined to produce a good cephalogram. Unit directly connected to the computer screen has also been used and marketed.[4]

Orthodontic patients consist of children and adults who come from different ethnic groups. Therefore appropriate reference values are important for diagnosis and proper treatment planning.[8] Lateral cephalometry values obtained from a person can change in terms of growth and after orthodontic treatment.[9] Peak growth in male occurs at age 14-15 years while in female between 11-12 years. After passing through a period of growth or at the age of 16-20 years, the skeletal changes are very little or not significant.[9]

Many studies have been conducted to obtain lateral cephalometry radiograph values on the various races and obtained different results. These studies were done on different races, populations and age ranges. There are two main races living in Indonesia. Mongoloid who dominantly lives in western and northern part of eastern Indonesia. Australo-Melanesian dominantly lives in east and the south east Indonesia. Mongoloid race is divided into two major groups namely Deutero-Malay and Proto-Malay.[10,11]

Research on the lateral cephalometry radiograph and related studies in Indonesia have been carried out mostly on the Deutero-Malay and Proto-Malay race. However research on Australo-Melanesian race and the publication on this subject are scarce. The objectives of this study were examining the differences of lateral cephalometry radiograph values between Australo-Melanesian and Deutero-Malay race at the age of 16-20 years with normal occlusion. Secondly, examining the difference of lateral cephalometry radiograph values between male and female in Australo-Melanesian race at the age of 16-20 years with normal occlusion. Thirdly, examining the difference of lateral cephalometry radiograph values between male and female in Deutero-Malay race at the age of 16-20 years with normal occlusion, to study the difference of lateral cephalometry radiograph values between Australo-Melanesian and Deutero-Malay race in male at the age of 16-20 years with normal occlusion. Forthly, examining the difference of lateral cephalometry radiograph values between Australo-Melanesian and Deutero-Malay race in female at the age of 16-20 years with normal occlusion.

## METHODS

Subjects participated in this study were 200 people, consisted of 50 males and 50 females Australo-Melanesian race, as well as 50 male and 50 female Deutero-Malay race. The subjects were students of Indonesia Advent University, Bandung and Santa Maria 1 and 2 High School, Bandung, age ranged from 16 to 20 years and met the inclusion criterias.

This study had been reviewed by the board of ethical committee Trisakti University. The film used for radiograph was Fuji Medical Dry Imaging Film (Japan) sized 26x36 cm or B4. The cephalograms were obtained from a single operator from the same digital cephalometric X-Ray machine (Vatech, South Korea). Distance from X-Ray tube to object's midsagital was 146cm and from the midsagital to film was 15cm. The subjects' head was fixed using cephalostat. Each cephalogram was traced on acetate paper (Ortho Organizer, USA) using H pencil (Staedtler, Germany) and measured using protractor ruler (Dentsply, USA). All measurements were recorded and repeated in 1 week interval by the same operator. Cephalometric analyzes used were compilation analysis and performed by measuring SNA angle, SNB angle, facial angle (Figure 1).[4]

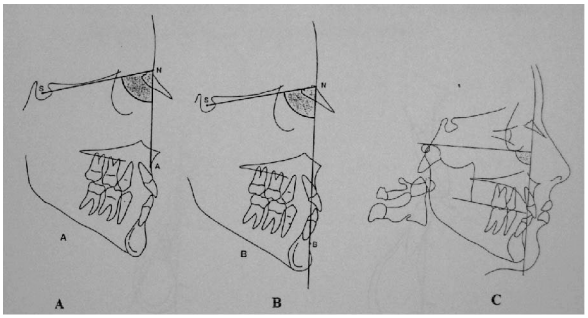


**Figure 1.** Cephalometry measurement. A. SNA angle; B. SNB angle; C. Facial angle[16]

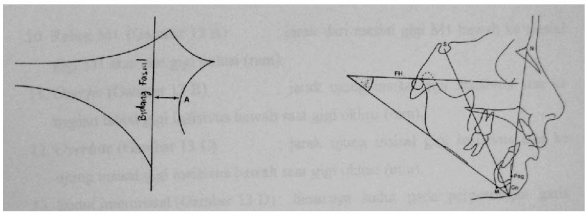

**Figure 2.** Cephalometry measurement. A. Convexity; B. FM angle[16]

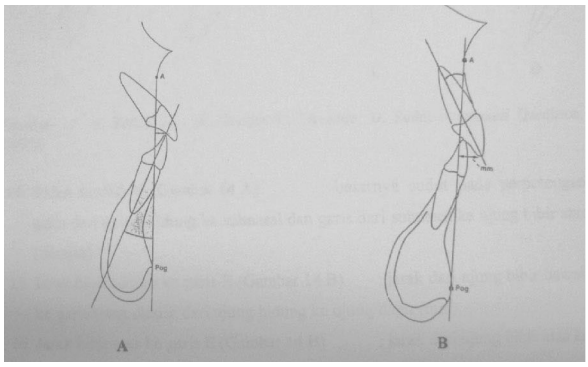


**Figure 3.** Cephalometry measurement. A. Lower I to APg distance and angle; B. Upper I to APg distance and angle[16]

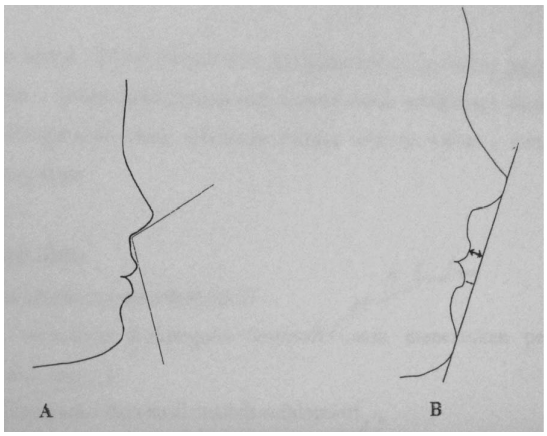


**Figure 4.** Cephalometry measurement. A. First molar relation; B. Overjet; C. Overbite; D. Interincisal angle[16]

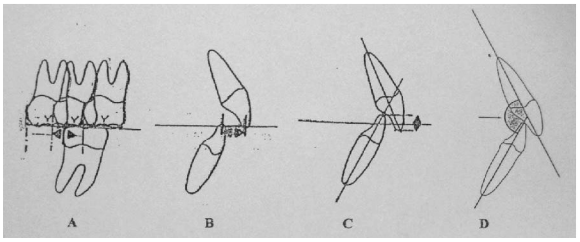


**Figure 5.** Cephalometry measurement. A. Nasolabial angle; B. Upper n lower lip distance to E line[16]

Measurement of convexity and FM angle (Figure 2), lower I to APg distance and angle with upper I to APg angle (Figure 3). Measurement of overjet, overbite and interincisal angle (Figure 4) and first molar relation, distance of lower lip to E line, distance of the upper lip to E line (Figure 5).

To compare the cephalometric measurements between Australo-Melanesian and Deutero-Malay race, non-parametric Mann Whitney U test was used for abnormal distributed variables data, while parametric independent *t*-test was used for normal distributed variables data. Reliability test of the result of measurements performed twice within 1 week interval time of 32 samples and the variables studied showed reliable measurement results with the Pearson correlation coefficient (r) ranged from 0.880-0.994 with $p$=0.000-0.005.

## RESULTS

The differences in cephalometry radiograph values between Australo-Melanesian and Deutero-Malay were found. Significant differences ($p$<0.05) obtained in SNA angle, distance of lower lip to E line, FM angle, upper incisor to APg angle (Table 1). These concluded that Australo-Melanesian has more protruded maxilla to cranial base, more frontal lower lip to esthetic line, more flat mandible, more procline upper incisor than Deutero-Malay. Table 2 shows the differences in cephalometry radiograph values between male and female in Australo-Melanesian and Deutero-Malay. Based on independent *t*-test, significant differences ($p$<0.05) was obtained in upper I to APg distance and nasolabial angle which means Australo-Melanesian female has more protrusive upper incisor (12.18±2.87mm) than male (10.91±2.48mm). Nasolabial angle of Australo-Melanesian male was more tapered (91.32±13.92°) than female (93.96±10.30°).

The difference between male and female Deutero-Malay was statistically significant ($p$<0.05) in SNA angle whereas other variables showed no significant difference ($p$>0.05) (Table 2). It showed a significant difference between Australo-Melanesian and Deutero-Malay male ($p$<0.05) in SNA angle, distance of lower lip to E line, FM angle, upper I to APg angle and distance of upper lip to E line. It indicated Australo-Melanesian male have more protrusive upper jaw, more frontal lower and upper lip to esthetic line, more flat mandible, more proclined

upper incisor compared to Deutero-Malay male. No significant difference between Australo-Melanesian and Deutero-Malay female was found in the majority of values ($p$>0.05) except for distance of lower lip to E line ($p$=0.000). This indicated that Australo-Melanesian female has more frontal lower lip to esthetic line than Deutero-Malay female. The 0.018 slot pre-adjusted appliance with Roth's prescription (Minisprint, Forestadent, Pforzheim, Germany) and molar bands with auxiliary tube were used. No pathologic condition was found on panoramic radiograph before treatment.

**Table 1.** The difference of cephalometry radiograph values between Australo-Melanesian and Deutero-Malay

| Variable | All | Male | Female |
|---|---|---|---|
| | *p* value | | |
| SNA angle (°) | *0.01 | *0.00 | 0.48 |
| SNB angle (°) | 0.63 | 0.52 | 0.83 |
| Facial angle (°) | 0.17 | 0.75 | 0.10 |
| Convexity (mm) | 0.39 | 0.12 | 0.89 |
| FM angle (°) | *0.04 | *0.03 | 0.11 |
| Lower I to APg (mm) | 0.62 | 0.64 | 0.48 |
| Lower I to APg angle (°) | 0.25 | 0.71 | 0.27 |
| Upper I to APg (mm) | 0.58 | 0.37 | 0.61 |
| Upper I to APg angle (°) | *0.03 | *0.04 | 0.32 |
| First molar relation (mm) | 0.08 | 0.07 | 0.52 |
| Overjet (mm) | 0.53 | 0.44 | 0.08 |
| Overbite (mm) | 0.25 | 0.14 | 0.94 |
| Interincisal angle (°) | 0.80 | 0.92 | 0.69 |
| Nasolabial angle (°) | 0.94 | 0.26 | 0.28 |
| Upper lip to E line (mm) | 0.05 | *0.02 | 0.49 |
| Lower lip to E line (mm) | *0.00 | *0.00 | *0.00 |

*= significant difference ($p$<0.05); Mann Whitney U test; independent *t*-test

**Table 2.** The difference of cephalometry radiograph values between male and female in Australo-Melanesian and Deutero-Malay

| Variable | Australo-Melanesian | Deutero-Malay |
|---|---|---|
| | *p* value | |
| SNA angle (°) | 0.74 | *0.04 |
| SNB angle (°) | 0.60 | 0.91 |
| Facial angle (°) | 0.16 | 0.74 |
| Convexity (mm) | 0.59 | 0.06 |
| FM angle (°) | 0.98 | 0.57 |
| Lower I to APg (mm) | 0.08 | 0.06 |
| Lower I to APg angle (°) | 0.58 | 0.13 |
| Upper I to APg (mm) | *0.02 | 0.10 |
| Upper I to APg angle (°) | 0.15 | 0.75 |
| First molar relation (mm) | 0.06 | 0.57 |
| *Overjet* (mm) | 0.53 | 0.06 |
| *Overbite* (mm) | 0.47 | 0.51 |
| Interincisal angle (°) | 0.24 | 0.14 |
| Nasolabial angle (°) | *0.03 | 0.95 |
| Upper lip to E line (mm) | 0.26 | 0.92 |
| Lower lip to E line (mm) | 0.08 | 0.78 |

*= significant difference ($p$<0.05); Mann Whitney U test; independent *t*-test

## DISCUSSION

Significant difference was found in the SNA angle between female and male of the two races. This result is consistent with previous study which obtained significant difference in SNA angle between male and female.[12] However, the result was contrary with the result of other study that stated there was no significant difference in the SNA angle between Deutero-Malay male and female.[13] This may be due to different age range of the subjects between the two studies, resulting in analysis of different growth state.[13] No difference in SNA angle between the two races in this study was supported by several studies performed previously in Caucasoid, Chinese, Saudi Arabian, Philipines and European-American subjects.[8,14-16]

Significant difference in SNA angle was also found in male Deutero-Malay and Australo-Melanesian. This was consistent with the study that found significant difference in SNA angle between Chinese ethnic with Caucasoid ethnic male.[8] There was no significant difference in SNB angle in male and female Deutero-Malay and Australo-Melanesian in this study. SNB angle in Deutero-Malay obtained was 79.33±3.79°. Australo-Melanesian was slightly having larger SNB angle, 79.99±3.70°, indicating this race tend to has more prognati mandible. Previous research showed SNB angle in Deutero-Malay was 79.6±3.4° in males and 80.3±3.2° in females.[13] SNB angle was found to be 79.95±3.40° in the Philiphines, the Kuwait 74.75±3.5°, the Saudi Arabian 77.5±4.48°, the Nigerian 81.2±4.0°, 78.12±2.96° in Poles which conclude Caucasoid (the Kuwait, Saudi Arabian, Poles) tend to have more retrognati mandible than Mongoloid (Philiphines and Deutero-Malay) and Negroid (Nigerian).[6,12,14-16]

Australo-Melanesian race has larger facial convexity (5.37±2.81mm) than Deutero-Malay (3.72±3.02mm) and female has more convex face than male in both races. Study conducted in the Philiphines also concluded that female has more convex face than male.[16] Facial angle values obtained in this study have no significant difference in comparison between race and gender. However, the facial angle mean in Australo-Melanesian was slightly larger (88.25°) than Deutero-Malay (87°). The Australo-Melanesian tend to have more prognati mandible to facial plane than Deutero-Malay. Comparison of FM angle between the two races in general and between male Deutero-Malay and Australo-Melanesian found significant difference. The values were smaller in Australo-Melanesian, indicating that Australo-Melanesian male (27.45± 4.49°) generally has more flat mandible than Deutero-Malay (28.14±5.36°). This finding was consistent with research that found significant difference in FM angle between the Saudis (28.5±4.79°) and the European-American (22.4±5.6°).[14] In Nigeria, the angle was 26.09±5.02°, demonstrated that Caucasoid and Negroid tend to have more flat mandible than Mongolid (Deutero-Malay).[6]

No significant differences in distance and angle of lower incisor to APg line in each comparison. Deutero-Malay and Australo-Melanesian female tends to have more protruded lower incisor than male while male of both races have more proclined lower incisor. Australo-Melanesian male and female tend to have more procline lower incisor than Deutero-Malay and so did the comparison of the two races in general. Lower incisor's position is important in orthodontic because it affects the length of orthodontic treatment and determinants of whether or not to do tooth extraction.[13] Therefore, when performing analysis on this variable, reference value corresponding to the race, age and sex of a person are needed.

There was significant difference in comparison of the upper incisor to APg angle between the two races in general, upper incisor to APg distance between Australo-Melanesian male and female, upper incisor to APg angle between Australo-Melanesian and Deutero-Malay male. This indicated that Australo-Melanesian female has more protruded upper incisor than male, and Australo-Melanesian has more proclined upper incisor than Deutero-Malay in general.

Australo-Melanesian has smaller interincisal angle (113.16 ± 9.67°) compared to Deutero-Malay (122.12 ± 10.45°) but not statistically significant. This suggests that Deutero-Malay tend to have deeper bite and Australo-Melanesian tend to have more protruded bite. The average interincisal angle of the Philippines was 117.5±6.2°, 109.10±8.04° of Nigerian, the Kuwait 121.00± 9.85°, 120.60±11.89° Saudi Arabians and Europeans-Americans 130.90±9.24°.[6,14-16] This angle determines the position and inclination of the upper and lower incisors, and often changed as a person performed orthodontic treatment.

Significant difference obtained in the nasolabial angle between males (91.32±13.92°) and females (93.96±10.30°), demonstrated that Australo-Melanesian male has more acute nasolabial angle than female. Australo-Melanesian race in general also has more acute nasolabial angle than Deutero-Malay although not significant. There was significant distance difference of upper lip to E line between Deutero-Malay and Australo-Melanesian race. This showed that Australo-Melanesian male has more prominent upper lip to the esthetic line compared to Deutero-Malay. In comparison of the lower lip distance to E line between the two races in general as well as comparison between the two races of male and female of both races concluded that this variable was affected by person's race. It was also influenced by the movement of anterior teeth, nose and chin growth.[13]

Limitations of this study was mainly due to the less number of samples. It is expected to do similar studies in the future with a larger number of samples that can represent the cephalometry radiograph values in Australo-Melanesian race.

## CONCLUSION

Variables value used as reference in cephalometry analysis must be in accordance with race, gender, and age of the patient when making diagnosis and treatment plan to achieve the maximum orthodontic treatment.

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